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Research paper

Central bank interest rate decisions, household indebtedness, and psychiatric morbidity and distress: Evidence from the UK

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ABSTRACT

Background: Central banks set economy-wide interest rates to meet exclusively economic objectives. There is a strong link between indebtedness and psychiatric morbidity at the individual level, with interest rates being an important factor determining ability to repay debt. However, no prior research has explored whether central bank interest rate changes directly influence mental health, nor whether this varies by levels of indebtedness.
Methods: We use British data (N = 93,255) to explore whether the Bank of England base-rate affected how perceived burden of non-mortgage debt (low, medium, and high) influenced psychiatric morbidity. Psychiatric morbidity was measured using the General Health Questionnaire (GHQ-12). Our primary outcome measure was a binary indicator of "psychiatric caseness" (> 3 on a 0–12 scale). We also used the GHQ-12 as a continuous measure of distress.
Results: When interest rates are high (low) there is an increased (decreased) risk of psychiatric morbidity only among those with a high debt burden (b = 0.026, p = 0.02). This result was robust to alternative explanations. Thus a 1 percentage point base-rate increase is associated with a 2.6% increase that someone with a high debt burden will experience psychiatric morbidity.
Limitations: Our study uses subjective indicators of debt burden. We were unable to determine the mechanism behind our effect.
Conclusions: Changes in central bank interest rates to meet economic objectives pose a threat to mental health. Mental health support is needed for those in debt and central banks may need to consider how their decisions influence population mental health.

1. Introduction

There is a strong link between problem debt and common mental disorders at the individual level (Drentea, 2000; Reading and Reynolds, 2001). The extent to which debt is a problem often depends upon personal factors, absolute level of debt, and income available to finance the debt (Fitch et al., 2011). However, there are also major economic policy decisions, outside of the control of the individual, which have the potential to both alleviate and intensify the incidence of mental health issues associated with debt. For example, fiscal policy, which is the means by which a government influences the economy via adjusting tax and spend levels, can influence the availability of mental health care resources (Saxena et al., 2007) and protect those who may be the most vulnerable to mental health issues (Lundin and Hemmingsson, 2009). Monetary policy, which is the counterpart to fiscal policy and conducted by central banks, influences the economy via controlling the economy's money supply (Mankiw, 2009). A key monetary policy tool for controlling the money supply is by changing the interest rate to which debt must be repaid. Although there is a literature highlighting important effects of macroeconomic factors (Faresjö et al., 2013; Katikireddi et al., 2012), there has been no research in assessing how central bank interest rate decisions, determined exogenously to the individual, might directly influence mental health.

The remit of a central bank is exclusively economic. For example, the Bank of England's stated objective is*"to maintain price stability – as defined by the Government's 2 percent inflation target – and, subject to that, to support the Government's economic policies, including those for growth and employment"* (Bank of England, 2013). Although there may be

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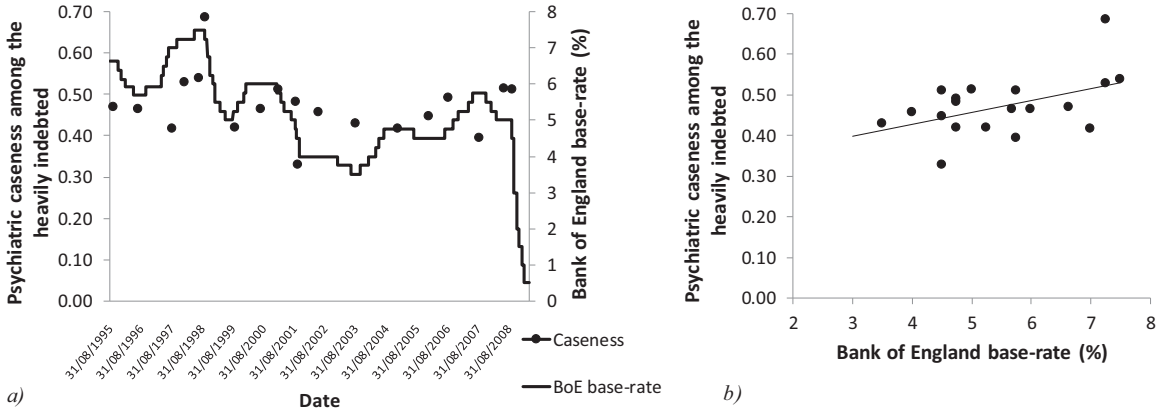

Fig. 1. The Bank of England base-rate (left hand vertical axis) and psychiatric caseness (top: right hand vertical axis, bottom: horizontal axis) among the heavily indebted in the corresponding base-rate period from September 1995-April 2009. We calculated the proportion of individuals reaching the threshold for psychiatric caseness/morbidity among persons that were heavily indebted across each of the 52 interest rate periods. In many cases there were insufficient observations to ensure reliable estimates of psychiatric caseness/morbidity among this group due to relatively few or no individuals being interviewed in that interest rate period (23 interest rate periods have 10 or less observations). We plotted for each interest rate period, where there were sufficient observations within each interest rate period ($n > 40$), the incidence of psychiatric caseness/morbidity against the Bank of England base-rate ($r = 0.48$, $p < 0.05$).

indirect societal-wide benefits to psychological health of having a stable economy with low unemployment (Reeves et al., 2014; Stuckler et al., 2009; Zivin et al., 2011) the tools that a central bank uses to achieve these economic objectives may themselves pose a direct psychological risk and this may in turn have an economic cost to society (see, Layard, 2006).

Central banks set the short-term interest rate – the base-rate – at which private banks can lend money from the Bank of England. Private banks then pass this interest rate change on to the wider economy via the rate individuals pay on loans or receive from savings (George et al., 1999). Based on previous literature there is good reason to suppose that those who are more greatly burdened by their debt will have non-trivial mental health reactions to changes in central bank interest rates. High levels of debt burden may reflect a 'moral stressor' (Doehring, 2016) where by"…one knows the right thing to do, but institutional constraints make it nearly impossible to pursue the right course of action" (Jameton, 1984, p. 6). This reflects uncertainty about a person's ability to fulfil their moral obligations (Reynolds et al., 2012), resulting in feelings of shame and guilt (Hirdman, 2016; Jeong, 2016). All else being equal, an external change in interest rates will affect the debtor's ability to manage their debt. However, a reduced sense of ability to repay, if already feeling guilty or shamed, may push the debtor towards social withdrawal and psychological distress. This may be especially the case for those with higher levels of debt burden, who are more likely to have lower self-efficacy (Kuhen and Melzer, 2017). Those with low self-efficacy report high levels of psychological distress (Selenko and Batinic, 2011) and seek less help for their debt (Lim et al., 2014) when financial stress is high (for example when interest rate changes affect the ability to repay). Furthermore, those with higher levels of debt burden are more present orientated, and therefore less able to plan for future changes (Webley and Nyhus, 2001). Thus, we hypothesise based on this previous literature that interest rate changes will influence the mental health of those with high debt burden.

2. Method

2.1. Participants

We examine our hypotheses using the British Household Panel Survey (BHPS), a randomly sampled longitudinal study of British households (see Taylor et al., 2010, for sampling information). The dataset includes 18 waves of data, beginning in September 1991, with the last wave of data collection taking place in April 2009. We use 14 waves of the BHPS from September 1995 to April 2009 where questions about debt and savings are available. In each wave of the BHPS the heads of each household are first interviewed to obtain household level information. Next individuals in the household are interviewed to gauge individual information, and then individuals are administered a self-completion questionnaire. The self-completion questionnaire contains questions relating to mental health. Since questions about debt are asked at the household level we focus on individuals that indicate that they are the head of their household and that were 18 or over. There were a total of 104,593 observations across 16,953 individuals indicating themselves as head of the household in the BHPS across this time period. Thus the same individuals, although not necessarily in every wave, are involved throughout the study. However, questions on mental health (8.7%) and questions about debt and savings (7.2%) were not answered in every year by every individual. Since these were our key hypothesis variables we included in our analysis only those observations with non-missing values for these key independent variables. This resulted in a sample that included 93,255 observations across 15,818 participants (34% female, age 18–100, $M = 50.57$, $SD = 17.72$).

2.2. Measures

2.2.1. Interest rates

Fig. 1 (left hand-section) shows that between September 1995 to April 2009 the Bank of England base-rate ranged from 0.5% to 7.5% and there were a total of 52 interest rate-periods (51 base-rate change announcements). We match the Bank of England base-rate with the day on which each individual was interviewed. Further, owing to either short interest-rate periods or that there were no interviews taking place from May to August some interest rate periods are matched to relatively few or no individuals. However, since the interest rate on the day of an individual's interview might not always represent the interest rate faced by the individual across the entire year we also examine the average of the Bank of England base-rate in the year up until the individual's interview (previous year's base-rate average) as an alternative indicator of interest rates.

Mental health was measured using the 12-item version of the General Health Questionnaire across all 14 waves. Items in the GHQ-12 (e.g., "*thinking of self as worthless*") are scored as follows: "*not at all = 0*", "*no more than usual = 0*", "*rather more than usual = 1*", or "*much more than usual = 1*" (range = 0–12). As a continuous measure this indicates general increasing *"psychological distress"* (Goldberg and Williams,

1991). although we carry out an analysis using the continuous measure, we also make use of the GHQ-12 as an indication of "*psychiatric caseness*", whereby this is indicated by a score above a threshold according to that set out in Goldberg et al. (1997) for various populations. The binary version of the GHQ-12, however, is typically used for clinical screening rather than a diagnostic tool and indicates psychiatric morbidity.

Household debt position is determined by answers to questions regarding debt and savings. In each wave of the BHPS individuals are asked: "*Do you save any amount of your income for example by putting something away now and then in a bank, building society, or Post Office account other than to meet regular bills?*" Individuals answer either yes or no.

Individuals are also asked: "*Do you or anyone in your household have to make repayments on hire purchases or loans?*" Individuals are specifically asked not to include mortgage loans but to include Department of Social Security (DSS) social fund loans. Individuals answer either yes or no. Directly following this the individual is then asked "*to what extent is the repayment of such debts and the interest a financial burden on your household?*" Individuals answered either "*a heavy burden*", "*somewhat of a burden*", or "*not a problem*" for their household. From this question we generated three dummy variables to indicate the extent to which debt, if present, was a burden on the household.

Those that reported that their debt was "not a problem" scored 1.55 (*SD* = 2.70, 95% *CI*: 1.51 – 1.59) on average using the GHQ-12 and had a psychiatric caseness rate of 0.16 (*SD* = 0.37, 95% *CI*: 0.16 – 0.17). Those that reported that their debt was "somewhat of a problem" scored 2.41 (*SD* = 3.34, 95% *CI*: 2.33 – 2.48) on average using the GHQ-12 and had a psychiatric caseness rate of 0.26 (*SD* = 0.44, 95% *CI*: 0.25 – 0.27). Those that reported that their debt was "a heavy burden" scored 4.13 (*SD* = 4.09, 95% *CI*: 3.98 – 4.23) on average using the GHQ-12 and had a psychiatric caseness rate of 0.46 (*SD* = 0.50, 95% *CI*: 0.44 – 0.48). ANOVA showed a significant difference between each of the groups in the GHQ-12 ($f = 662.28$, $p = 0.000$, $r^2 = 0.02$) and the incidence of psychiatric caseness ($f = 491.26$, $p = 0.000$, $r^2 = 0.02$).

We also calculated the proportion of individuals reaching the threshold for psychiatric caseness among persons that were heavily indebted across each of the 52 interest rate periods. In many cases there were insufficient observations to ensure reliable estimates of psychiatric caseness among this group due to relatively few or no individuals being interviewed in that interest rate period (23 interest rate periods have 10 or less observations). In Fig. 1 we plotted for each interest rate period, where there were sufficient observations within each interest rate period ($n > 40$), the incidence of psychiatric caseness against the Bank of England base-rate ($r = 0.48$, $p < 0.05$).

The subjective nature of the question on debt burden may draw some concern. However, it has been suggested, for example, that objective indicators do not give a complete picture of the pressures of debt as there are often factors that we cannot observe that may make debt a problem (Keese, 2012). Further, there is also some concern that the question itself, due to an explicit reference to interest, may prime individuals into thinking about the prevailing interest rate rather than the burden of repaying their debt. Thus, it is possible that our key variable acts only as an indication of an individual disliking interest rather than the size of their debt. We, therefore, attempt an objective verification of our indicator of problem debt using self-reported level of debt and the ratio of this debt to household income. In waves 5, 10, and 15 of the BHPS individuals are asked whether they have any financial commitments apart from mortgages. Individuals are then asked how much to the nearest pound sterling they owe on these commitments. Those who "*don't know*" are further asked in turn whether the amount is more than £00, 100, £500, £1500, £5000, £10,000. After recoding each of the categorical answers to the means of those who gave precise values of their debt (e.g., the mean debt of those with between £100 and £500 was inputted for those who had more that £100 of debt but less than £500) we then divided this amount of debt by household income to give a debt to income ratio. Those who reported a heavy burden of debt had an average debt of £6,122 (*SD* = 9415, 95% *CI*: 5354 – 6890), representing a debt to household income ratio of 0.36 (*SD* = 0.95, 95% *CI*: 0.28–0.44), whereas those who reported debt was somewhat of a burden had a mean debt of £ 4,578 (*SD* = 7304, 95% *CI*: 4226 – 4930) and a debt to household income ratio of 0.24 (*SD* = 1.16, 95% *CI*: 0.19 – 0.30). Those who reported that debt was not a problem had a debt level of £ 3,757 (*SD* = 10,563, 95% *CI*: 3389–4126) with a ratio of 0.21 (*SD* = 2.54, 95% *CI*: 0.12 – 0.30). ANOVA showed that there was a significant difference between the absolute levels of debt ($f = 468.8$, $p = 0.000$, $r^2 = 0.07$) and follow up t-tests showed that absolute levels of debt in all categories were significantly different from each other (lowest $t = 2.78$, highest $p = 0.006$). Since those that indicated they had a higher debt burden also had higher objective debt we take this as evidence of a reliable indicator of problem debt and that it is unlikely to only indicate a dislike of interest rates.

2.2.2. Covariates

There are a number of factors that are likely to correlate with an individual's household debt position and mental health. Thus we include in all our regressions a set of observable controls including education level, marital status, household size and whether there were children in the house, disability status, employment status, and log of household income. There was missing data for some of these covariates. Where there was missing data for categorical variables we included an extra category to indicate those individuals who had missing data. Where there were missing values for continuous variables; the log of household income (0.4%), we imputed values using multiple imputation (Rubin, 2004). Table 1 gives descriptive statistics across the variables in our mental health sample.

We also included in all regressions time-period dummies to account for national factors, such as macroeconomic conditions, that may have simultaneously influenced both debt and mental health. Although there is no strong reason to think that our effect will be explained by macroeconomic factors other than interest rates it is important to eliminate these potential explanations. Thus in a later robustness test we include

Table 1
Descriptive Statistics of household heads from the British Household Panel Survey that answered both GHQ-12 questionnaire and answered the household debt position variables (N = 93,255).

Variable	Mean (standard deviation)
GHQ-12 Psychiatric Caseness (0; 1):	0.20 (0.40)
GHQ-12 "bi-modal" Psychological distress:	1.90 (3.01)
Household debt position:	
Savers	0.40
Debt not a problem	0.17
Debt somewhat of a burden	0.09
Heavy debt burden	0.03
Age	50.57 (17.72)
Female = 1	0.34
Marital Status:	
Married = 1	0.49
Never married = 1	0.22
Widowed =1	0.13
Divorced = 1	0.13
Separated = 1	0.03
Household size	2.44 (1.32)
Has children = 1	0.30
Highest educational qualification	
GCSE = 1	0.26
A-level = 1	0.25
Degree = 1	0.14
Unemployed = 1	0.03
Retired = 1	0.25
Disabled = 1	0.11
Household income	£25,420 (22,050)

macroeconomic variables directly, as well as their interaction with our household debt position variables. Specifically, we include unemployment rate in the month of the interview, regional house price growth in the quarter of the interview, and inflation and GDP per capita growth rate in the year of the interview.

2.3. Empirical specification

We investigate how interest rates at the time of an individual's interview relate to mental health, as indicated by scores om the GHQ-12 (caseness/morbidity or continuous), using the following model:

$$Mental\ \ Health_{it} = \beta_0 + \beta_1 r_{it} + \beta_2 Saver_{it} + \beta_3 Saver_{it}{}^{*} r_{it} + \beta_4 Debt\ \ Burden_{it} + Debt\ \ Burden_{it}{}^{*} r_{it} + \mu_i + \delta_t + \sum_{k=1}^{k} \beta_k x_{kit} + \varepsilon_{it} \quad (1)$$

Where Debt Burden is the extent the individual thinks their debt is a burden to their household and captured using dummy variables. Not a problem, somewhat of a problem, a heavy burden, relative to those with no debt.

Mental health for individual *i* at time *t*, depends on the interest rate faced by an individual at the time of the interview, *r*. We expect the effect of the interest rate on individual mental health to be dependent on a household's debt position. Thus we include indicators of whether an individual saves, and the extent to which any unsecured debt, if they have any, is a burden on their household as main effect variables. We also interact these variables with interest rates so as to determine whether there are differences in how interest rates influence individuals in each of these groups. Whilst we expect there may be some benefit when interest rates are high for savers (a positive coefficient on the interaction term for savers – $\beta_3 Saver^{*}r$) and some detriment to those with some debt we expect a high interest rate to be particularly detrimental for those with a heavy debt burden (i.e., a large negative coefficient on the interest rate-heavy burden interaction term).

There are a number of factors that may explain both debt and mental health. This includes time-period factors that would be expected to influence all individuals equally at any given time-period, δ, an array of *k* observable characteristics *x,* and individual specific factors, μ. We account for the time period factors, δ, by including dummy variables to indicate the wave in which an individual's interview took place. We control for observable characteristics, *x*, by including demographic and socio-economic variables. Individual specific factors, μ, consist of potential confounding aspects that are characteristic of the individual but are unobservable, immeasurable, or simply unknown. Such baseline individual differences might include, for example, people's perception of how bad debt is, personality characteristics, self-efficacy, and/or ability to forward plan. Baseline levels of unobserved or unknown variables are fully controlled for through estimation based on explaining the within-person variation relationship of the variables. Our within-person estimation strategy fully exploits the longitudinal nature of the data and minimises the possibility that unchanging individual specific factors that are unobservable, immeasurable, or simply unknown drive our results. Additionally, variables that are known but do not vary across time, such as sex, are implicitly controlled for in the analysis. Although the focus on within-person changes across time results in imprecise estimates on variables that do not have high within person variation (Boyce, 2010) our approach does, since interest rates are determined exogenously to the individual, enable a possible causal interpretation (Angrist and Pischke, 2008). In our models any components that remain unexplainable are assumed to be captured by an idiosyncratic error term ε.

In all cases we assume linearity in our dependent variables. This includes the psychiatric caseness/morbidity binary outcome variable where we carry out an estimation using a linear probability model. Since individuals and interest rates are measured at different levels i.e. we observe the same individuals across a number of time-points and interest rates are the same within a given time-period for many individuals, the error terms are likely to be clustered. We account for clustering for both levels of measurement by estimating 2 way standard errors (Cameron and Miller, 2015). All analyses were carried out using Stata 12.

Table 2
The Influence of the Bank of England Base-Rate on Mental Health Moderated by Household Debt Position in the British Household Panel Survey (N = 93,255).

Dependent variables:	Independent variable:			
	Psychiatric Caseness/ morbidity (0; 1)		GHQ-12 "continuous" (0–12)	
	(1)	(2)	(3)	(4)
Interest rate	−0.002	−0.011	−0.031	−0.051
	(0.005)	(0.011)	(0.031)	(0.079)
Saver	−0.003	−0.005	−0.108	−0.107
	(0.011)	(0.014)	(0.090)	(0.103)
Interest rate*Saver	−0.003	−0.002	−0.008	−0.008
	(0.002)	(0.003)	(0.018)	(0.019)
Debt not a problem	0.012	0.024	0.097	−0.116
	(0.018)	(0.019)	(0.126)	(0.131)
Interest rate*Debt not a problem	−0.004	−0.006†	−0.037	−0.040
	(0.004)	(0.004)	(0.025)	(0.024)
Somewhat of a debt burden	0.021	−0.001	0.336*	0.184
	(0.022)	(0.027)	(0.168)	(0.196)
Interest rate*Somewhat of a debt burden	−0.001	0.003	−0.029	0.000
	(0.004)	(0.005)	(0.030)	(0.037)
Heavy debt burden	−0.002	−0.035	0.001	−0.321
	(0.045)	(0.053)	(0.283)	(0.400)
Interest rate*Heavy debt burden	**0.020****	**0.026****	**0.169****	**0.228****
	(0.008)	**(0.010)**	**(0.049)**	**(0.074)**
Constant	0.132	0.165	1.259	1.262
	(0.208)	(0.212)	(1.811)	(1.777)
Interest rate variable	Day of interview	Year Average	Day of interview	Year Average
Controls for macroeconomic interaction effects	No	No	No	No
Observations	93,255	93,255	93,255	93,255
Number of individuals	15,818	15,818	15,818	15,818

Notes: All regressions include controls for demographic and socio-economic circumstances (education level, marital status, occupational status, household size and whether there were children in the house, disability status, and log of household income), individual specific factors (by assessing within-person variation), and time-period effects (including time-period dummies). In Regressions 1 and 3 we estimate robust standard errors that account for non-nested clustering at both the individual level and the interest rate period in which individuals were interviewed.

** $p < 0.01$.

* $p < 0.05$.

3. Results

We first examine the extent to which the Bank of England base-rate on the day of an individual's survey interview predicts mental health. We then examine whether using the average interest rate over the year up until the individual's survey interview provide a better explanation. Table 2 shows the results. Columns 1 and 2 show the results for psychiatric caseness/morbidity and columns 3 and 4 show the results when GHQ-12 is treated as a continuous measure. Across all analyses interest rates are on average not linked to mental health. However, a consideration of the interaction terms suggests that the influence of interest rates on mental health depends on household debt position. We observe that with increasing debt burden there is a tendency toward reduced mental health when interest rates are high. In particular, for those that experience debt as a heavy burden there is a negative effect on mental health when interest rates are high. We note, however, that none of the main effects on our savings or debt burden variables are significant.

Given that we observed strong cross-sectional differences between mental health and our debt burden variables as highlighted in our Methods section this may draw some concern. However, this is likely to arise in part because our estimation strategy, which focuses exclusively on within-person variation and, therefore, allows a possible causal interpretation, is known to produce imprecise estimates on variables that do not vary much within individuals (Boyce, 2010). Since our savings and debt burden variables vary little over time for each individual relative to the variation across individuals this explains this effect.

Results from the linear probability regression using the average interest rate over the previous year in column 2 suggest that a one percentage point increase in the base-rate is linked to a 2.6% increase in the likelihood that someone with a heavy debt burden will experience psychiatric morbidity. If we were to consider an interest rate movement of 4 percentage points (93% of the observations in our sample experienced interest rates between 3.5% and 7.5%) this would increase the relative risk of someone with a heavy debt burden by 10.4%.[2] Although these effects might be considered small (between 0.05 and 0.10 of a standard deviation) given that our analyses are based on within-person changes and interest rate changes are exogenous to the individual our results have a possible causal interpretation (Angrist and Pischke, 2008).

3.1. Alternative macroeconomic explanations

An alternative explanation of our result is that this effect is driven by other macroeconomic variables correlated with the Bank of England base-rate. Over the time period of our study as average interest rates in the previous year correlates with monthly unemployment rate ($r = 0.58$), yearly inflation rate ($r = 0.06$), yearly GDP per capita growth rate ($r = -0.21$), and quarterly house price growth ($r = 0.18$). To account for these alternative explanations, we include the unemployment rate in the month of the interview, regional house price growth in the quarter of the interview, and inflation and GDP per capita growth rate in the year of the interview as additional explanatory variables, as well as their interactions with the household debt position variables – savers and debt burden. The results using average interest rates are found in Table 3 and show our results are robust to these alternative explanations. Further, since there were substantial macroeconomic changes, which included dramatic Bank of England base-rate decreases, in the final wave of our data we also re-ran our analyses excluding the final wave. The results were consistent with our main analyses.

Table 3
The Influence of the Bank of England Base-Rate on Mental Health Moderated by Household Debt Position Accounting for Alternative Macro-Economic Explanations.

Dependent variables:	Independent variable:	
	Psychiatric Caseness/ morbidity (0; 1) (1)	GHQ-12 "continuous" (0–12) (2)
Interest rate	−0.014	−0.099
	(0.012)	(0.085)
Saver	−0.018	−0.150
	(0.020)	(0.145)
Interest rate*Saver	−0.001	0.004
	(0.004)	(0.027)
Debt not a problem	−0.034	0.087
	(0.025)	(0.178)
Interest rate*Debt not a problem	−0.013**	−0.091**
	(0.005)	(0.051)
Somewhat of a debt burden	0.015	0.435
	(0.037)	(0.267)
Interest rate*Somewhat of a debt burden	−0.003	−0.003
	(0.007)	(0.055)
Heavy debt burden	−0.044	−0.352
	(0.070)	(0.541)
Interest rate*Heavy debt burden	**0.030***	**0.261***
	(0.014)	**(0.104)**
Constant	0.361	3.198†
	(0.243)	(1.923)
Interest rate variable	Year Average	Year Average
Controls for macroeconomic interaction effects	Yes	Yes
Observations	93,255	93,255
Number of individuals	15,818	15,818

Notes: All regressions include controls for demographic and socio-economic circumstances (education level, marital status, occupational status, household size and whether there were children in the house, disability status, and log of household income), individual specific factors (by assessing within-person variation), and time-period effects (including time-period dummies), macro-economic interactions (monthly unemployment rate, regional quarterly house price growth, inflation, and GDP per capita growth rate as main effect variables and interactions with household debt position). We estimate robust standard errors at the individual level.

** $p < 0.01$.

* $p < 0.05$.

4. Discussion

Our research is the first to illustrate that monetary policy decisions, via changes in interest rates, can have direct implications for mental health. Our analyses revealed, as hypothesised, that when economy-wide interest rates are high (low) there is an increased (decreased) risk of lower mental health among the heavily indebted. Since interest rates are determined primarily by factors exogenous to the individual and we examined within-person changes our results have a possible causal interpretation, with a one percentage point increase in the Bank of England base-rate increasing the risk of psychiatric caseness/morbidity by at least 2.6% among those heavily indebted.

Governments, policymakers, and mental health practitioners need to be aware of the implications that monetary policy decisions may have on mental health. Access to credit is an important aspect of modern society and may help individuals invest in their future, but debt, which is at present at historically high levels, may become unsustainable. Low interest rates may be useful for increasing investment and therefore boosting a country's economy but low rates also encourage the uptake of more personal debt (Gross and Souleles, 2002). When interest rates are low high debt may be serviceable but as these rates rise high levels of debt may become unmanageable and put many people's mental health at risk. Although those heavily indebted represented only 2.9% of observations in our sample this suggests that in a country, such as the UK, where there are 26.4 million households, we would expect there to be approximately 800,000 households with a heavy debt burden. Our finding of a marginal effect of 2.6% increase in psychiatric caseness/morbidity with each percentage point increase in interest rates (if only the household heads were affected) suggests there would be approximately 20,000 additional cases of psychiatric caseness/morbidity. The cost to society of one individual with psychiatric morbidity has been estimated to be at least £7,880 (Layard, 2006) and therefore an overall societal cost of each percentage point increase would be £156 million. Although it is important central banks maintain economic objectives, which may indirectly benefit mental health, there is a case for central banks to consider direct welfare implications of their decisions. There is also a strong public health case to intervene before mental health reaches crisis levels as a result of high indebtedness.

Economy-wide interest rate changes, however, are not the only monetary tool that central banks can use to influence the economy

[2] We explored different thresholds for psychiatric caseness. In our sample when we selected a cut-off of > 2 the incidence rate was 26%, whereas a cut-off of > 4 gave an incidence rate of 16%. When we analysed our data using these alternate thresholds the coefficients on the heavy debt were statistically significant for both a cut-off > 2 ($b = 0.033$) and a cut-off > 4 ($b = 0.020$).

(Joyce et al., 2011). Quantitative easing (Joyce et al., 2011) is another strategy that attempts to increase demand in an economy through directly increasing the money supply. Some have suggested that a better way to improve the economy would be to give individuals money in the form of a debt jubilee (Keen, 2011). To the extent that such a debt jubilee would decrease individual debt burden, and therefore the risk of psychiatric morbidity, our study supports such an approach.

Our study is not without limitations. We cannot be completely certain as to the extent to which the Bank of England base-rate translates to market rates. Although the transmission mechanism is almost immediate (George et al., 1999) we are unable to know the exact rates paid by individuals on their debt. For example, those with problem debt may only have access to loans with particularly high rates. However, whilst rates may differ across specific types of debt we believe that Bank of England base-rate will act as a good proxy for changes across different markets. A further issue is that we do not know the exact mechanism by which interest rate changes influenced an individual's mental health. For example, it is not clear whether people are explicitly aware of the interest rate changes. Thus any effect could have been via direct impacts on an individual's debt repayments or rather through anticipatory effects about future debt repayments due to individuals following Bank of England base-rate decisions and concerns for the future economy. This may be individual specific and driven by personality characteristics (see, e.g., Boyce et al., 2016). However, since our results were stronger using the Bank of England base-rate experienced over the previous year we suspect it is more likely the former. Perhaps a useful avenue for future research in exploring these mechanisms would be to explore objective finance related behaviour. It is also likely that people may vary considerably in their levels of debt between measurement points. We were unable to account for potential debt variation but this would be an interesting area to explore. Our study also only focused on non-mortgage debt. Mortgage debt is an important part of household debt, which can often be the most burdensome. There are several reasons why we did not include mortgage debt. First, the dataset did not contain an appropriate variable that would have enabled us to investigate the importance of mortgage debt (for example, the size of the mortgage debt was unknown and there was no indication as to the burden it placed on the household). Second, a large proportion of the mortgage debt in the UK is based on fixed interest rates and therefore would not be expected to be influenced. Further, we did not have information as to whether a household's mortgage was fixed or variable. Third, mortgage debt is secured against the property and we wanted to focus on unsecured debt, which has different consequences if not repaid. The extent to which a household found their unsecured debt a burden would have depended on other expenditures, which may have included mortgage debt. We believe it likely that were a household finding their mortgage debt a heavy burden then they would have also indicted that their unsecured debt would be a heavy burden. Nevertheless, this is a limitation of our study and an issue to address in future research. Although we objectively validated our subjective indicators of debt we cannot rule out the possibility that those with mental health issues may experience debt as burdensome at levels that are relatively low. Nevertheless, our study is the first of its kind in demonstrating a direct pathway by which central bank monetary policy decisions influence the prevalence of psychiatric caseness/morbidity. Now that this initial demonstration has been made we recommend that future research try to examine mechanistic pathways and overcome some of these limitations by exploring, for example, objective indicators of debt burden and by examining debt specific interest rates.

While others have begun to show that central banks decisions might influence psychological health *indirectly* (Blanchflower et al., 2014) we are the first to show a *direct* pathway to mental health. Our work therefore fits with the literature highlighting the stressful effects of adverse macroeconomic conditions (Faresjö et al., 2013; Katikireddi et al., 2012). More generally there is a growing interest in using non-economic indicators to guide policy (Stiglitz et al., 2009) and it has been suggested that central banks should also explicitly target psychological factors (Di Tella and MacCulloch, 2009). Our research offers further support for this perspective.

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